UNITED STATES PATENT APPLICATION

OF

Tae Min KIM and Hyo Jae LEE

FOR

HERMETIC COMPRESSOR

[0001] This application claims the benefit of the Korean Application No. P2003-080528, filed on November 14, 2003, which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates to compressors, and more particularly, to a hermetic compressor.

Background of the Related Art

[0003] In general, the hermetic compressor compresses low temperature, low pressure gaseous refrigerant into high temperature, high pressure gaseous refrigerant in a refrigerating system. The hermetic compressor is provided with a compression part for compressing the refrigerant, a motor part for supplying power to the compression part, and a hermetic container for holding the compression part and the motor part. The refrigerant is compressed by a piston reciprocating within a cylinder.

[0004] FIG. 1 illustrates a section of a related art hermetic compressor.

[0005] Referring to FIG. 1, the hermetic compressor is provided with a container 1 having a lower container 1a and an upper container 1b, for hermetically sealing an inside space thereof. The container 1 contains a motor part 4 having a stator 2 and a rotor 3.

[0006] The stator 2 has slots having many coils wound therearound, with the rotor 3 rotatably provided to an inside thereof. The rotor 3 has a vertical pass through hole 3a in a central part wherein a rotation shaft 5 is mounted. The rotation shaft 5 is rotated with the rotor 3. There are a plurality of springs 'S' under the stator 2 for absorbing vibration transmitted from the rotor 3 to the stator 2 when the rotor 3 rotates.

[0007] The compression part is on the motor part 4. The compression part is provided with a cylinder 7 for compressing the refrigerant therein, and a piston 8 for reciprocating

along an inside circumferential surface of the cylinder 7. There is an eccentric part 5a on top of the rotation shaft 5 eccentric from an axis of the rotation shaft, and connected to the piston 8 with a connecting rod 9. Therefore, a rotation force of the rotation shaft 5 is transmitted to the piston 8.

[0008] The rotation of the rotation shaft 5 is converted into a horizontal reciprocating movement at the connecting rod 9 connected to the eccentric part 5a. The connecting rod 9 has a hole at one end thereof having the eccentric part 5a rotatably inserted therein, with a cylindrical sleeve 10 between the hole and the eccentric part 5a. The sleeve 10 makes the connecting rod 9 and the eccentric part 5a to come into close contact.

[0009] When the piston 8 reciprocates along an inside surface of the cylinder 7, the refrigerant is drawn-in, compressed, and discharged, repeatedly. For stabilizing the rotation speed of the rotation shaft 5, a balance weight 5b is provided to a circumference of the eccentric part 5a.

[0010] In the meantime, the rotation shaft 5 has an oil feed for drawing, and pumping up oil held on a bottom of the lower container 1a. Accordingly, when the rotation shaft 5 rotates, the oil rises along the oil feed, and sprayed onto the cylinder 7, piston 8, and the connecting rod 9.

[0011] There is a cylinder block 6 over the motor part having a boss 6a projected downward from a central part thereof. The rotation shaft 5 is rotatably provided passed through the boss 6a. That is, the rotation shaft 5 rotates sliding along an inside circumferential surface of the boss 6a.

[0012] The cylinder 7 is in one side part of an upper part of the cylinder block 6 fabricated as one unit with the cylinder block 6, for compressing the refrigerant. The piston 8 reciprocates along the inside circumferential surface of the cylinder 7.

[0013] There is a valve assembly 11 in front of the cylinder 7. The valve assembly 11 controls introduction/discharge of the refrigerant into/from the cylinder. There is a head cover 12 at an outer side of the valve assembly 11 for isolating drawing refrigerant from discharging refrigerant. There is a suction muffler 13 under the head cover 12. The suction muffler 13 attenuates noise of the drawing refrigerant, and prevents the drawing refrigerant from being heated.

[0014] In the meantime, there is a discharge muffler at one side of the cylinder 7 for attenuating noise from the compressed refrigerant. The discharge muffler has one end of a loop pipe 20 connected thereto. The loop pipe 20 has the other end connected to a discharge pipe 15 which discharges the refrigerant to an outside of the compressor. Accordingly, the loop pipe 20 guides the high temperature, high pressure refrigerant from the cylinder 7 to an outside of the compressor.

[0015] The loop pipe 20 is formed of copper, or steel. For reducing vibration of the loop pipe 20, the loop pipe 20 is provided with a coil weight 22 of a spring form at an outer side thereof.

[0016] However, the related art hermetic compressor has the following problems.

[0017] First, heat dissipated from the high temperature, high pressure refrigerant flowing through the loop pipe is transmitted to the suction muffler, to heat the drawing refrigerant, with a consequential increase of a specific volume, that drops an efficiency of the compressor.

[0018] Second, if the coil weight is not fitted accurately, the loop pipe and the coil weight hit each other, to increase noise on the contrary due to this.

[0019] Third, fitting of the coil weight is complicate, and increases a production cost.

SUMMARY OF THE INVENTION

[0020] Accordingly, the present invention is directed to a hermetic compressor that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

[0021] An object of the present invention is to provide a hermetic compressor which has an improved loop pipe.

[0022] Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0023] To achieve these objects and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, the hermetic compressor includes a hermetic container having an enclosed space therein, a motor part in the hermetic container for converting an electric energy into a kinetic energy, a compression part connected to the motor part for compressing low temperature, low pressure refrigerant into high temperature, high pressure refrigerant, a discharge muffler adjacent to the compression part for attenuating noise of the refrigerant compressed into high temperature and high pressure, a discharge pipe passed through one side of the hermetic container for discharging the refrigerant to an outside of the compressor, and a loop pipe of a synthetic resin between the discharge muffler and the discharge pipe.

[0024] The loop pipe is bent at least once. It is preferable that the loop pipe further includes a transit tube. The transit tubes are fitted to both ends of the loop pipe respectively,

and formed of metal.

[0025] The synthetic resin is Teflon, and the synthetic resin has elasticity for absorbing vibration from the compressor.

[0026] The hermetic container includes a lower container having a downward hollow, and an upper container on an upper rim of the lower container. The lower container has a hole at one side having a discharge pipe fitted therethrough.

[0027] The motor part includes a stator in a lower part of an inside of the hermetic container, a rotor inserted to an inside of the stator for rotating upon reception of a power, and a rotation shaft passed through a central part of the rotor and projected upward by a predetermined length.

[0028] The rotation shaft includes an eccentric part in a top part eccentric from a rotation axis, and the rotation shaft includes a balance weight in the upper part thereof for stabilizing a rotation speed of the rotation shaft. The hermetic compressor further includes a plurality of springs under the stator for absorbing vibration.

[0029] The compression part includes a cylinder having a space therein for compressing the refrigerant, a piston for reciprocating along an inside circumferential surface of the cylinder, a valve assembly for controlling refrigerant suction into/discharge from an inside of the cylinder, and a connecting rod for converting a rotation force of the motor into a reciprocating movement, and transmitting to the piston.

[0030] The hermetic compressor further includes a cylinder block over the motor part having the cylinder formed on one side of upper surface of the cylinder block as one unit with the cylinder block. The valve assembly further includes a head cover for isolating refrigerant being drawn into the cylinder, from refrigerant discharged from the cylinder.

[0031] The hermetic compressor further includes a pseudo-discharge muffler on an

opposite side of the discharge muffler with reference to the compression part. The hermetic compressor further includes supporting parts on opposite side parts of an underside of the lower container, and a rubber seat in a low part of each corner of the supporting parts.

[0032] In other aspect of the present invention, there is a hermetic compressor including a hermetic container having an enclosed space therein, a motor part in the hermetic container for converting an electric energy into a kinetic energy, a compression part connected to the motor part for compressing low temperature, low pressure refrigerant into high temperature, high pressure refrigerant, a discharge muffler adjacent to the compression part for attenuating noise of the refrigerant compressed into high temperature and high pressure, a discharge pipe passed through one side of the hermetic container for discharging the refrigerant to an outside of the compressor, and a loop pipe of a synthetic resin between the discharge muffler and the discharge pipe, having transit tube at both ends, respectively.

[0033] It is to be understood that both the foregoing description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention claimed.

BRIEF DESCRITPION OF THE DRAWINGS

[0034] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention.

In the drawings;

FIG. 1 illustrates a section of a related art hermetic compressor;

FIG. 2 illustrates a disassembled perspective view of a hermetic compressor of the present invention;

FIG. 3 illustrates a perspective view of a loop pipe in accordance with a preferred embodiment of the present invention; and

FIG. 4 illustrates a perspective view of a loop pipe in accordance with another preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0035] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. In describing the embodiments, same parts will be given the same names and reference symbols, and repetitive description of which will be omitted.

[0036] Respective embodiments of the hermetic compressor of the present invention will be described with reference to FIGS. 2 ~ 4. FIG. 2 illustrates a disassembled perspective view of a hermetic compressor of the present invention.

[0037] Referring to FIG. 2, on an outside of the hermetic compressor, there are an oval lower container 100 having a downward hollow space, and an upper container (not shown) having an upward hollow space for covering a top of the lower container 100.

[0038] There are supporting parts 110 on opposite side parts of an underside of the lower container 100. There is a rubber seat (not shown) between the supporting parts 110 and a floor of a room for absorbing vibration generated at the compressor. An upper part of the rubber seat is inserted in a seat hole 110a formed in the supporting part 110. For adjusting a horizontal position of the lower container 100, the seat hole 110a is formed at each of corners of the supporting parts 110.

[0039] The lower container 100 has a cover bracket 130 for fastening a terminal cover (not shown) thereto, and a suction pipe, a discharge pipe 150b, and a refrigerant pipe 150c on one side surface thereof passed therethrough.

[0040] The refrigerant is drawn into an inside of the compressor through the suction pipe 150a, and discharged to an outside of the compressor through a discharge pipe 150b opposite to the suction pipe 150a after being compressed in the compressor. There is a refrigerant pipe 150c adjacent to the discharge pipe 150b for filling refrigerant at an initial setting of the compressor. Therefore, the refrigerant pipe 150c is sealed after the refrigerant is filled.

[0041] In the meantime, the lower container 100 has a motor part 200 and a compression part 300 provided therein. The motor part 200 has a stator 210 and a rotor 230 for converting an external electric energy into a kinetic energy.

[0042] The stator 210 has radial slots each having a coil wound therearound a number of times, and the rotor 230 is in an inside of the stator 210. The rotor 230 has a rotation shaft 310 at the central part. Once power is supplied to the coils, a magnetic field is formed around the stator 210, when the rotor 230 rotates together with the rotation shaft 310.

[0043] There is a cylinder block 330 over the motor part 200, having a cylinder 330b thereon. The cylinder block 330 has a boss 330a projected downward from a central part, and the rotation shaft 310 is rotatably mounted in the boss 330a passed therethrough.

[0044] Front and rear of the cylinder 330b are opened. The front has a valve assembly 370 provided thereto for controlling suction and discharge of refrigerant, and the rear has a piston 350 inserted therethrough. There is a head cover 390 in front of the valve assembly 370 for isolating discharged refrigerant, and drawn refrigerant. There is a suction muffler 400 under the head cover 150a for attenuating noise of the refrigerant drawing into the cylinder 330b.

[0045] The rotation shaft 310 has an eccentric part 310a at a top part thereof eccentric from a rotation axis, and the piston 350 is coupled to the eccentric part 310 with a connecting

rod 355. Accordingly, the connecting rod 355 has one end connected to a rear end of the piston 350, and the other end connected to the eccentric part 310a. The connecting rod 355 has a ring part 355a at the other end for rotatably inserting the eccentric part 310a.

[0046] The connecting rod 355 converts rotation of the eccentric part into a reciprocating movement. If the eccentric part 310a rotates, the connecting rod 355 reciprocates along an inside circumferential surface of the piston 350, horizontally. In this instance, the piston repeats a process for drawing, compressing, and discharging the refrigerant.

[0047] In the meantime, there is a discharge muffler 330c on one side of the cylinder 330b. The head cover 390 has a pipe at one side thereof for guiding refrigerant from the cylinder 330b to the discharge muffler 330c. The discharge muffler 330c is provided as a unit with, or separate from the cylinder block 330.

[0048] The discharge muffler 330c is connected to a discharge side of the head cover 390 for receiving compressed refrigerant from the cylinder 330b through a flow passage in the head cover 390.

[0049] The discharge muffler 330c has a muffler cover 330d at a top part for preventing the refrigerant from leaking. There is a loop pipe 500 having one end passed through the muffler cover 330d. The loop pipe 500 guides the refrigerant from the discharge muffler 330c to the discharge pipe 150b.

[0050] There is a pseudo-discharge muffler 330c' on an opposite side of the discharge muffler330c with reference to the cylinder 330a. The pseudo-discharge muffler 330c' is provided for making a weight balance with the discharge silencer 330c. Moreover, the pseudo-discharge muffler 330c' may be used as a supplementary discharge muffler by connecting a pipe thereto if necessary.

[0051] In the meantime, the loop pipe 500 passed through the muffler cover 330d will be described in detail. FIG. 3 illustrates a perspective view of a loop pipe in accordance with a preferred embodiment of the present invention, and FIG. 4 illustrates a perspective view of a loop pipe in accordance with another preferred embodiment of the present invention.

[0052] Referring to FIG. 3, the loop pipe 500 is provided in a state bent a number of times. The loop pipe 500 has one end connected to the discharge muffler 330c and the other end connected to the discharge pipe 150b. Therefore, the refrigerant compressed at the cylinder 330b is guided to the discharge pipe 150b through the discharge muffler 330c and the loop pipe 500.

[0053] In order to prevent heat dissipated from the high temperature, high pressure refrigerant flowing an inside of through the loop pipe 500 from transmitting to an outside of the loop pipe 500, the loop pipe 500 is formed of a synthetic resin having a low heat transfer coefficient, such as Teflon.

[0054] If the heat is transferred to the low temperature, low pressure refrigerant being drawn into the cylinder 330b, since a specific volume of the refrigerant increases, to decrease a mass flow rate of the refrigerant being drawn into the cylinder 330b, an efficiency of the compressor drops. For preventing this, the loop pipe 500 is formed of the synthetic resin.

[0055] Because the synthetic resin has a heat transfer coefficient lower than metal, the loop pipe 500 formed of the synthetic resin suppresses transfer of the heat from the refrigerant flowing through an inside of the loop pipe 500 to other components.

[0056] Moreover, the loop pipe 500 of the synthetic resin has elasticity. The loop pipe 500 of the synthetic resin has a better damping effect with respect to vibration. Therefore, because the vibration taken place during operation of the hermetic compressor is attenuated and absorbed by the loop pipe 500 itself, breakage of a part of a connection part of the loop

pipe 500 is prevented.

[0057] Furthermore, since the loop pipe 500 of the synthetic resin, having an excellent chemical resistance, does not deform, or dissolve even if the loop pipe 500 comes into contact with the refrigerant or the oil.

[0058] FIG. 4 illustrates a perspective view of a loop pipe in accordance with another preferred embodiment of the present invention.

[0059] Referring to FIG. 4, the loop pipe 500 has transit tubes 500', additionally. The transit tube 500' is formed of metal, and inserted on both ends of the loop pipe 500. That is, the transit tubes 500' are fitted to connection parts between the loop pipe and the muffler cover 330d, and between the loop pipe and the discharge pipe 150b, for preventing the connection parts from being broken due to vibration caused when the compressed is operated.

[0060] In the meantime, fitting positions of the transit tube 500' are not limited to the both ends of the loop pipe 500. For preventing the loop pipe 500 from hitting the lower container or neighboring components and suffering from damage, the fitting positions of the transit tube 500' may be varied.

[0061] A process for fabricating the loop pipe 500 will be described.

[0062] The loop pipe 500 is fabricated in a bent form from the starting, or by bending a straight pipe. The fabrication of the loop pipe 500 in a bent form from the starting is done by injecting the synthetic resin raw material into a mold having a required form, subjecting to a solidification process, and separating the mold.

[0063] On the other hand, the fabrication of the loop pipe 500 by bending a straight pipe is done by bending the straight pipe after heating the straight pipe. Upon repeating above process, the loop pipe 500 bent a number of times can be fabricated.

[0064] A refrigerant flow in the hermetic compressor of the present invention will be

described.

[0065] The refrigerant, converted into low temperature, low pressure gas when the refrigerant passes through the evaporator in the refrigerating cycle, is introduced into an inside of the hermetic compressor through the suction pipe 150a connected to the lower container 100. The refrigerant passes the suction muffler 400 and a suction side of the head cover 390, and is introduced into an inside of the cylinder 330b, when the suction valve of the valve assembly 370 is opened.

[0066] Meantime, as the piston moves forward, the drawn refrigerant is compressed into a high temperature, and high pressure state. Then, the refrigerant is discharged through a discharge valve of the valve assembly 370, passes the discharge muffler 330c, and the discharge pipe 150b, and discharged to an outside of the hermetic compressor.

[0067] Then, the refrigerant circulates through a condenser, an expansion valve, and an evaporator in succession, and re-enters into the suction pipe 150a of the hermetic compressor, again. Thus, the refrigerant forms a refrigerating cycle, and cools spaces, such as the refrigerating chamber in the refrigerator.

[0068] As has been described, the hermetic compressor of the present invention has the following advantages.

[0069] First, the loop pipe of synthetic resin suppresses heat transfer from the high temperature, high pressure refrigerant flowing an inside of the loop pipe to an outside of the loop pipe. According to this, heat transfer to the refrigerant being drawn into the cylinder is prevented, and an efficiency of the hermetic compressor increases.

[0070] Second, the elastic loop pipe of synthetic resin absorbs vibration by itself, to dispense with the coil weight, and simplify a fitting process of the loop pipe, and reduce a production cost of the hermetic compressor.

[0071] The loop pipe of synthetic resin has a good chemical resistance, to prevent corrosion caused by reaction with the refrigerant.

[0072] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.